UNSINKABLE VESSEL SYSTEM

BACKGROUND OF THE INVENTION

Field of the invention

[0001] This invention relates to systems which render ships and boats unsinkable.

Description of the related art

[0002] The prior art is aware of supplementary devices which inflate automatically or manually to provide additional buoyancy in the event of water leakage into the vessel. The following is a brief description of the prior art which is pertinent to the present invention.

[0003] US Pat. No. 3,121,888 to Morgan et al discloses a protected inflatable member present along the top of the outside surface of the hull. When needed, this inflatable member is filled with gas from a pressurized air cylinder in order to provide a buoyant bag along the top of the boat to keep the boat afloat

[0004] US Pat. No. 4,512,275 to Drumm discloses a boat which is unsinkable because it is made of polyethylene foam, which will not sink even though the hull becomes filled with water.

[0005] US Pat. No. 4,817,555 to Meinen discloses a boat containing a canister of compressed air which is automatically actuated by the rising of a float inside the boat. Upon opening of the canister, longitudinal bags along the top of the hull outside the boat are inflated to keep the boat afloat.

[0006] US Pat. No. 4,864,961 to Slonski discloses an auxiliary flotation apparatus for vessels which comprises canisters connected to a source of compressed air, an inclinometer, and an independent power source. When needed, the compressed air is

released into the canisters. When pressurized air enters the canisters, a projectile is propelled away from each canister. The projectile ruptures a frangible membrane located flush with the hull of the vessel. The projectile goes beyond the vessel and carries with it an attached inflatable tubular sheath. One end of the tubular sheath is attached to the hull of the vessel. The sheath becomes filled with air from the source of compressed air, providing a buoyant bag on the outside of the vessel to maintain the vessel afloat.

[0007] US Pat. No. 5,357,888 to Insinna discloses a vessel having an elongated inflatable buoyancy tube located on the outside of the hull. The tube is connected to a source of compressed air which, when automatically or manually activated, provides air to the buoyancy tube to keep the vessel afloat.

[0008] Of the above patents, one prevents boats from sinking because the boat is made from foam plastic. The other patents disclose buoyant bags fitted to the outside of the craft. These bags can do nothing to affect the entry of water into the craft, and they do no more than merely provide buoyancy.

[0009] US Pat. No. 4,458,618 to Tuffier is the prior art of which the inventor is aware which is the closest to the present invention. This patent discloses vessels having enclosed areas such as cabins. The vessels are equipped with three inflatable envelopes. A compressed air container is attached to the three envelopes so that, when needed, the envelopes may be automatically or manually inflated to render the boat buoyant. If the event causing water within the craft is a hole in the hull, the inflated envelopes do nothing to keep the water from continuing to come in. Also, repeated contact with the original cause of the damage could cause puncture of one of the envelopes, causing the boat to be capsized.

SUMMARY OF THE INVENTION

[0010] A common cause of sinking in vessels is a rupture in the hull. As a result of the rupture, water enters the hull or the space between a double-walled hull and replaces the air. The added weight of the water eventually causes the vessel to weigh more than its volume of water, and sinking results. A way to avoid sinking is to provide bags of air either within the confines of the hull of the vessel or between the walls of a double-hulled vessel. These bags may provide the necessary buoyancy to keep the vessel afloat and/or apply sufficient pressure against the hull as to prevent the entry of water. It is the purpose of the present invention to provide three alternative systems for performing these functions. The time required for a ship to sink is related to the size of the ship and the size of rupture. According to the present invention, while water is filling the hull, air is being forced into air bags by a compressor. Ultimately, the buoyant effect of the filling air bags will meet with the sinking effect of the incoming water. As the compressor is able to compress air at a higher pressure than the incoming water, the bags will begin to expand into areas occupied by water and to push water back out of the rupture. According to the present invention, the air bags are mounted so that when inflated to a maximum pressure, they will be six inches from the inner wall of the hull. This distance reduces the possibility of a piercing of the bags by jagged edges of the rupture while rendering the vessel sufficiently buoyant to remain afloat and operative. The system of the present invention thus gives the crew adequate time to repair the rupture and render the vessel seaworthy.

BRIEF DESCRIPTION OF THE DRAWING

[0011] Fig. 1 is an elevational rear view of a vessel of the first embodiment of this invention, partly in cut-away, illustrating a deflated bag during storage, an air compressor, a compression chamber, and a time valve.

[0012] Fig. 2 is an elevational side view of a vessel of the first embodiment of this invention, partly in cut-away, illustrating a deflated bag during storage, an air compressor, a compression chamber, and a time valve. The vessel is shown as having a rupture.

[0013] Fig. 3 is an elevational front view of a vessel of the first embodiment of this invention, partly in cut-away, illustrating a deflated bag during storage. The craft is shown as having a rupture.

[0014] Fig. 4 is a cut-away bottom view of a vessel of the first embodiment of this invention illustrating a deflated bag during storage. The bag is held by tie-down straps. Also illustrated are diameter restrictor/gauge tracks and airbag diameter securement fasteners.

[0015] Fig. 5 is an elevational rear view of a vessel of the first embodiment of this invention, partly in cut-away, illustrating a fully inflated airbag following activation of the system of the present invention.

[0016] Fig. 6 is an elevational side view, partly in cut away, of a vessel of the first embodiment of this invention illustrating a fully inflated airbag pushing water out through a rupture.

[0017] Fig. 7 is an elevational front view of a vessel of the first embodiment of this invention, partly in cut-away, illustrating a fully inflated airbag pushing water out through a rupture.

[0018] Fig. 8 is a cut-away bottom view of a vessel of the first embodiment of this invention illustrating an inflating airbag expanding on diameter restrictor/gauge tracks, an air compressor, and a compression chamber.

[0019] Fig. 9 is an elevational rear view of a vessel of the second embodiment of this invention, partly in cut-away, illustrating a deflated bag during storage, an air compressor, a compression chamber, and a time valve.

[0020] Fig. 10 is an elevational side view of a vessel of the second embodiment of this invention, partly in cut-away, illustrating a deflated bag during storage, an air compressor, a compression chamber, and a time valve. The vessel is shown as having a rupture.

[0021] Fig. 11 is an elevational front view of a vessel of the second embodiment of this invention, partly in cut-away, illustrating a deflated bag during storage. The craft is shown as having a rupture.

[0022] Fig. 12 is a cut-away bottom view of a vessel of the second embodiment of this invention illustrating a deflated bag during storage. The bag is held by tie-down straps. Also illustrated are diameter restrictor/gauge tracks and airbag diameter securement fasteners.

[0023] Fig. 13 is an elevational rear view of a vessel of the second embodiment of this invention, partly in cut-away, illustrating a fully inflated airbag following activation of the system of the present invention.

[0024] Fig. 14 is an elevational side view of a vessel of the second embodiment of this invention, partly in cut-away, illustrating a fully inflated airbag pushing water out through a rupture.

[0025] Fig. 15 is an elevational front view of a vessel of the second embodiment of this invention, partly in cut-away, illustrating a fully inflated airbag pushing water out through a rupture.

[0026] Fig. 16 is a cut-away bottom view of a vessel of the second embodiment of this invention illustrating an inflating airbag expanding on diameter restrictor/gauge tracks, an air compressor, a compression chamber, and a time valve.

[0027] Fig. 17 is an elevational rear view of a vessel of the third embodiment of this invention, partly in cut-away, illustrating a deflated bag during storage and an air compressor.

[0028] Fig. 18 is an elevational side view of a vessel of the third embodiment of this invention, partly in cut-away illustrating a deflated bag during storage and an air compressor. The vessel is shown as having a rupture.

[0029] Fig. 19 is an elevational front view of a vessel of the third embodiment of this invention, partly in cut-away, illustrating a deflated bag during storage. The craft is shown as having a rupture.

[0030] Fig. 20 is a cut-away bottom view of a vessel of the third embodiment of this invention illustrating a deflated bag during storage. The bag is held by tie-down straps. Also illustrated are diameter restrictor/gauge tracks and airbag diameter securement fasteners.

[0031] Fig. 21 is an elevational rear view of a vessel of the third embodiment of this invention, partly in cut-away, illustrating fully inflated airbags following activation of the system of the present invention.

[0032] Fig. 22 is an elevational side view of a vessel of the third embodiment of this invention, partly in cut-away, illustrating fully inflated airbags pushing water out through a rupture.

[0033] Fig. 23 is an elevational front view of a vessel of the third embodiment of this invention, partly in cut-away, illustrating fully inflated airbags pushing water out through a rupture.

[0034] Fig. 24 is a cut-away bottom view of a vessel of the third embodiment of this invention illustrating inflating airbags expanding on diameter restrictor/gauge tracks and an air compressor.

[0035] Fig. 25 is an elevational bottom view of a diameter restrictor/gauge track and an airbag diameter securement latch device coupled to it illustrating the relaxed position of the airbag diameter securement latch device secured into a fixed diameter setting and springs.

[0036] Fig. 26 is an elevational bottom view, partly in cut-away, of a diameter restrictor/gauge track and an airbag diameter securement latch device coupled to it riding the narrow neck to snap into the next setting. The Fig. illustrates the compression of a spring-loading mechanism.

[0037] Fig. 27 is an elevational side view of an air compressor illustrating generator impellers, a partial view of the control panel, and cold air input for the heating elements.

[0038] Fig. 28 is an elevational top view of an air compressor, partly in cut-away, illustrating inner gears, a generator, and an air filter.

[0039] Fig. 29 is an elevational side view of a clutch device used in this invention.

[0040] Fig. 30 is an elevational side view of a primary conduit, a secondary conduit, and an inter-bag valve.

[0041] Fig. 31 is an elevational side view, partly in cut-away, of a vessel containing the warning system which is part of this invention.

[0042] Fig. 32 is an elevational front view of sonar equipment which may be used in this invention.

[0043] Fig. 33 is an elevational perspective view of sonar equipment which may be used in this invention.

[0044] Fig. 34 is an elevational exploded front view of sonar equipment which may be used in this invention.

[0045] Fig. 35 is an elevational exploded perspective view of sonar equipment which may be used in this invention.

[0046] Fig. 36 is a rear elevational view, partly in cut-away showing a re-entry system of the present invention.

[0047] Fig. 37 is a side elevational view, partly in cut-away, showing a re-entry system of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0048] The present invention will now be more fully described with reference to the above drawing, wherein like identifying numerals refer to like parts throughout.

[0049] Prior to the discussion of the separate embodiments of this invention, the different parts of the system of a vessel **2** will be discussed.

[0050] The separate parts of the system are at least one air compressor **4**, a compression chamber **6**, a compressor/propeller clutch **8**, at least one inflatable airbag **10**, heating elements **12**, and a diameter restrictor/gauge track **14**. Additional features of this invention include sonar warning system **16** for warning to avoid potential harm to the vessel **2** and a re-entry system **18** which transfers air from the inflated airbags **10** to the inside of a repaired vessel **2**.

[0051] It has been seen that the systems of the prior art, especially those systems used for smaller boats wherein the airbags are on the outside of the boat, use air or other gas provided from a gas cylinder. The system of the present invention is intended for use in larger vessels **2** where size and weight of the vessel would be considerably higher and wherein gas cylinders could not supply adequate volumes of air. Thus, in the present invention, an air compressor **4** is used. Two types of air compressors are preferred, each having its own strengths and preferred times of use. Each of these air compressors is made of plastic or metal. Plastic is preferred as plastic is not affected by the sea air and water while metal is and plastic is lighter in weight than metal of a corresponding strength.

[0052] The first type of air compressor **4** is a large impeller **20**-equipped compressor **4** which is capable of moving large quantities of air from the surrounding atmosphere to the compression chamber **6**. This compressor **4** contains multiple long, overlapping impeller blades **20**. It powers a generator **22** through electromagnetic induction provided by the vessel's **2** engine **24** through a clutch **8** to supply power to heating elements **12** for use when needed and to the control panel **28**. The control panel supplies activation controls and diameter indicator lights which indicate the position of

the air bag **10** along the diameter restrictor/gauge track **14**. The compressor **4** is connected to a control panel **28** which provides switches for the activation of the system and/or to determine the position of the inflatable bags **10** through indicator lights connected to sensors located on the diameter restrictor/gauge tracks **14**. The air compressor **4** is bolted down on the deck above the engine **24**. A long axle **30** extends from the air compressor **4** into a clutch **8** device which is attached to the axles **32** connecting the engine **24** and propeller (not shown). An electric motor (not shown) is provided to power the air compressor **4** in the event of failure of the vessel's **2** engine **24**. The electric motor provides a back-up system in the event of engine **24** failure. An electric cord connects the electric motor to the vessel's **2** batteries allowing the motor to spin the compressor's **4** impellers **20** as needed. To lessen the load on the electric motor, a ratchet clutch in the compressor **4** may disengage the shaft to the compressor/propeller clutch **8**.

[0053] The first type of air compressor **4** is responsible for building up the necessary compression for the initial filling of the inflatable bags **10**.

[0054] A second type of air compressor (not shown) may optionally be used in unison with the first type of compressor **4**. The second type, a piston air compressor, may be initiated when the impeller compressor **4** has reached its maximum compression. The piston compressor is slower, but is capable of generating higher compression values. Both the impeller compressor **4** and the piston compressor are known in the art and need not be further detailed.

[0055] The compressors **4** feed atmospheric air under pressure into compression chambers **6**. The compression chambers **6** are capable of holding large amounts of air

under high pressure. A large diaphragm **34** makes up part of one wall of the compression chamber **6**. There are three valves in the compression chamber **6**. The first is a time valve **36** which opens and closes at pre-determined intervals set at the control panel **28**. This valve **36** allows pressurized air to be stored and released into the inflatable bags **10**. The second is made up by the throat for the piston-type compressor (not shown). The third valve is the bypass valve (not shown) for exhaust gasses. Each compression chamber **6** has two water sensors (not shown) inside the chamber **6**, one just below, and one just above, the time valve **36**. When water is sensed, indicating the presence of water in the compression chamber **6**, a signal is sent to the control panel **28** to shut down the system. This signal may be overridden by a crew member. The closing down of the system is a safety feature which prevents the taking on of water by the air compressor **4** and air compression chamber **6** in the event the vessel **2** becomes submerged or overturned. By stopping the system, the inflatable airbags **10** will retain whatever air they have rather than have the bags **10** filled with water. This feature allows the vessel **2** to maintain whatever buoyancy has been provided by the air already introduced into the system.

[0056] A compressor/propeller clutch **8** is in a T-shaped housing and permits independent or simultaneous operation of the air compressor **4** impellers **20** and propellers (not shown) for the vessel **2**. A toothed gear axle **30** from the compressor **6** is attached to this clutch **8** which, in turn, is attached to the driveshaft **32** of the vessel's **2** engine **24** to turn the vessel's **2** propellers (not shown). The electrically controlled clutch **8** can be set at the control panel to run either or both the vessel's **2** propellers (not shown) and the air compressor's **4** impellers **20**.

[0057] Inflatable airbags **10** are large airbags **10** made of tear- and puncture-resistant material. A wide variety of materials may be used to prepare the bags **10**. Metal foil, especially aluminum foil is one example. Multi-ply rubber and canvas are other examples. The most preferred material is KEVLAR, noted for its strength and ability to resist punctures. In this respect, any one bag **10** may have multiple layers. The bags **10** may be single bags **10** or have a bag-in-a-bag configuration. The inflatable bags **10** are adapted to be inflated from an outside source of air. Thus, in the event the vessel **2** is sunk or overturned, the inflatable bags **10** may be filled with air by connecting a hose to the intake port of the compression chamber **6** and supplying pressurized air to fill the inflatable bags **10** to add buoyancy to the vessel **2**.

[0058] In addition to being inflated by air from the compression chamber **6**, the inflatable airbags **10** may be inflated by using the exhaust gasses from the vessel's engine **24**.

[0059] The inflatable airbags **10** are provided with sealed, water-proof heating elements **12**. These elements **12** heat and expand the air in the bags **10** in the event a larger volume or degree of compression of the air in the bags **10** is required. Thus, if the rupture is so large that the incoming water is greater in volume than the air introduced into the airbags **10** by the compressor **4**, the air in the bags **10** is heated to expand it and so provide a larger volume effect. The uninflated bags **10** are held in place by tie-down straps **38** which snap upon inflation of the bags **10**.

[0060] The operation of the diameter restrictor/gauge track **14** and associated airbag diameter securement latch device **40** may be best understood with reference to Figs. 25 and 26. The diameter restrictor/gauge track **14** is a slotted track on which the

inflatable bag **10** rides as it is expanding toward maximum inflation. The airbag diameter securement latch devices **40** possess spring-loaded adjusting rings **42**. The airbag diameter securement latch devices **40** attach the inflatable bags **10** to the diameter restrictor/gauge track **14**. The track **14** provides large orifices **44** in which the male protruding nub (not shown) of the airbag diameter securement latch device **40** is secured in a relaxed manner, allowing the buildup of air pressure. Pressure from the air compressor **4** forces the airbag diameter securement latch device **40** along the track **14** to larger diameter settings. In doing so, the spring-loaded adjusting ring **42** of the airbag diameter securement latch device **40** is compressed, which causes it to go into the narrow passage **46** and ultimately into the next large relaxed orifice **44** setting where it snaps back open, securing the position of the inflatable bag **10** until increased back pressure becomes so great as to push it through the next narrow passage **46**.

[0061] Each bag **10** contains a diameter track guide/securement latch **48**, which is a coupling attaching the airbag **10** to the tracks **14** at the perimeter of the airbag **10** which rides along the tracks **14**. As noted above, pressure within the airbag **10** overcomes the resistance of the tracks **14** by forcing the spring-loaded adjustment ring **42** of the airbag securement latch device **40** to compress and ride through the narrow passages **46**, snapping into the next large orifice **44**.

[0062] In each of the embodiments, the inflatable bag **10** may be placed between the inner **50** and outer **52** walls of the hull **54** or may be placed in the open space of the interior **56** of the vessel **2**. It is required that the space for the bag **10** be enclosed so that the bag **10**, upon inflating, will not expand into the atmosphere surrounding the vessel **2** but will tend to form pressure against the inner **50** and/or outer wall **52** of the hull **54**.

[0063] When the inflatable bag **10** is located in the interior **56** of the vessel **2**, it will, upon inflating, form pressure against the inner aspect of the inner wall **50** of the hull **54** and lend buoyancy to the interior **56** of the vessel **2**. When forming pressure against the inner wall **50** of the hull **54**, water is kept from entering the interior **56** of the vessel **2**.

[0064] When the inflatable bag **10** is located between the inner **50** and outer **52** walls of the hull **54**, it will, upon inflating, form pressure against both the inner **50** and outer **52** walls of the hull **54** and lend buoyancy to the space between the inner **50** and outer **52** walls of the hull **54**. When forming pressure against the inner **50** and outer **52** walls of the hull **54**, water is kept from entering the space between the inner **50** and outer **52** walls of the hull **54** and is kept from entering the interior **56** of the vessel **2**.

[0065] The first embodiment will now be described with reference to Figs. 1-8.

[0066] In the first embodiment, a series of single bags **10** (as opposed to a bag within a bag) is deployed on the diameter restrictor/gauge track **14** by the airbag securement latch device **40**. The bags **10** are deployed on the interior of the hull **54**. Upon activation, the compressor **4** forces air under pressure into the compression chamber **6**. The time valve **36** of the compression chamber **6** opens at designated time intervals which vary according to the size of the vessel **2**. Upon opening of the time valve **36**, air is sent through primary conduits **58** (pipes and/or hoses) to the inflatable bags **10**. The primary conduits **58** branch off into secondary conduits **60** which contain one-way valves (not shown). These valves prevent the loss of air in the remainder of the system in the event one bag **10** is ruptured. Inflation of the inflatable bags **10** adds buoyancy to the vessel **2** to keep it afloat. In the event the rupture to the hull **54** has penetrated both the inner **50** and outer **52** wall of the hull **54**, the pressure of a bag **10**

against the inner aspect of the inner wall **50** of the hull **54** will tend to confine the water to the space between the inner **50** and outer **52** walls of the hull **54**. In the event the inflatable bag ruptures **10**, the continued feeding of pressurized air to the ruptured bag **10** will result in the feeding of air to a sealed-off compartment of the vessel **2**. This will tend to prevent complete flooding of the compartment.

[0067] In the second embodiment, a series of three-chambered main airbags **62** (a bag-within-a-bag-within-a-bag) having an inner chamber **64**, a central chamber **66**, and an outer chamber **68** along with smaller auxiliary inflatable bags **70** at the top of the main bags **62** is deployed on the diameter restrictor/gauge track **14** by the airbag securement latch device **40**. The bags **62, 70** are deployed on the interior of the hull **54**. Upon activation, the compressor **4** forces air under pressure into the compression chamber **6**. The time valve **36** of the compression chamber **6** opens at designated time intervals which vary according to the size of the vessel **2**. Upon opening of the time valve **36**, air is sent through primary conduits **58** (pipes and/or hoses) to the inflatable bags **10**. The primary conduits **58** branch off into secondary conduits **60** which contain one-way valves. These valves prevent the loss of air in the remainder of the system in the event one bag **62, 70** is ruptured. As shown in Fig. 30, the system having three-chambered bags **62** contains a series of inter-bag valves **72** which separate the chambers **64, 66, 68** from each other. These valves **72** permit the inner chambers **64** to be filled first as ports **74** to these chambers **64** are free. After the inner chamber **64** is pressurized to its maximum capacity, a butterfly valve (not shown) seals the port to the inner chamber **64** to shut off and lock this port so that no air can leave or enter the inner chamber **64** and all additional air from the compressor **4** is directed into the central **66** and outer **88**

chambers. The central **66** and outer **68** chambers also contain butterfly valves that seal the ports to these chambers **66, 68** when maximum pressure is attained. These valves are spring loaded and are capable of reopening to allow the entrance of air if the pressure in the chambers **64, 66, 68** drops below the set maximum pressure. However, the entrance ports **76, 78** to the central **66** and outer **68** chambers of the three-chambered bags **62** are later pressure-loaded to the maximum pressure setting of the inner chambers **64**. After the maximum pressure setting of the inner chamber **64** is attained, a butterfly valve (not shown) seals the port **74** to the inner chamber **64** so that no air can leave or enter the inner chamber **64** and all additional air from the air compressor **4** is directed into the central chamber **66** and then into the main outer chamber **68**. The central chamber **66** and the main outer chamber **68** possess reverse butterfly valves (not shown) which close when maximum pressure is attained. These valves may be reopened if the pressure within the controlled chamber **66, 68** drops below the maximum setting. These valves are electrically connected to the compressor **4** controls so that the compressor **4** may be shut down when all of the valves are closed and is opened when one or more of the valves is opened. Inflation of the inflatable bags **62, 64** adds buoyancy to the vessel **2** to keep it afloat. In the event rupture to the hull **54** has penetrated both the inner **50** and outer **52** wall of the hull **54**, the pressure of a bag **62, 70** against the inner aspect of the inner wall **50** of the hull will tend to confine the water to the space between the inner **50** and outer **52** walls of the hull **54**. In the event the outer chamber **68** of the main bag **62** ruptures, the presence of inflated central **66** and inner **64** chambers and auxiliary bags **70** will maintain pressure against the inner aspect of the inner wall **50** to continue to

maintain pressure against the incoming water, and will tend to confine the incoming water to the space between the inner **50** and outer **52** walls of the hull **54**.

[0068] In the third embodiment, a series of single bags **10** is deployed on the diameter restrictor/gauge track **14** by the airbag securement latch device **40**. The bags **10** are deployed between the inner **50** and outer **52** walls of the hull **54**. Upon opening of the time valve **36**, air is sent from the compression chamber **6** through primary conduits **58** (pipes and/or hoses) to the inflatable bags **10**. The primary conduits **58** branch off into secondary conduits **60** which contain one-way valves (not shown). These valves prevent the loss of air in the remainder of the system in the event one bag **10** is ruptured. The inflation of the inflatable bags **10** adds buoyancy to the vessel **2** to keep it afloat. The pressure of a bag **10** against the inner aspect of the outer wall **52** of the hull **54** will tend to prevent the water from entering the space between the inner **50** and outer **52** walls of the hull **54**. Should both the inner **50** and outer **52** walls of the hull **54** be ruptured, pressure of the inflatable bag **10** against the inner wall **50** of the hull **54** tends to cover the point of rupture of the inner hull and prevent water from entering the interior of the vessel.

[0069] While it is intended to present a system which will be capable of keeping a vessel **2** afloat in the event the hull **54** has been punctured, it is obvious that it is best if the system is never needed. For this reason, the inventor has coupled the above-described buoyancy system with a sonar warning system **16** to be described below.

[0070] The warning system **16** can best be understood by reference to Figs. 31-35. According to this invention, the transmitter **80** and the receiver **82** may be located in a single unit or in two separate units. Both the transmitter **80** and the receiver **82** are

located on the exterior of the vessel **2** in such a way that they may be easily removed. This includes attachment bases **84** attached to the front of the vessel **2** and a transmitter **80** and receiver **82** removably attached to the attachment bases **84**. The sonar system **16** is to be used in conjunction with the buoyancy system in order to provide a safety system. The first element of the safety system warns of danger and allows the controller of the vessel **2** to avoid danger. The second element of the safety system provides for buoyancy and water elimination in the event of rupture in spite of the presence of the first element.

[0071] The deployment of the above-described system adds buoyancy to the vessel **2** and also prevents water from entering the vessel **2**. This gives the crew time to make temporary repairs to the hull **54** which may be in the form of sealants or welded patches.

[0072] With reference to Figs. 36 and 37, a reentry system **18** is described which finds utility following the stopping of water intake and repair of the rupture of the hull **54**. Once air in the inflatable bags **10** is no longer necessary, the air may be released through escape valves (not shown). In the event it is still necessary or desirable to have pressurized air in a compartment which has a slow leak, air may be transferred from an inflated bag **10**, through the air compression chamber **6**, and through an air re-entry conduit **90** to the affected sealed compartments where pressurized air is desired.

[0073] Although the invention has been described and illustrated in detail, it is to be clearly understood that the same is by way of illustration and example, and is not to be taken by way of limitation. The spirit and scope of the present invention are to be limited only by the terms of the appended claims.